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A Method of Appraising Pine Sawtimber in South Carolina

by

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INTRODUCTION

Every forest landowner who offers his standing trees for sale must answer the question, "How much is my stumpage worth?" Few, especially among the small owners, can make a reasonable estimate.

One reason owners find it difficult to appraise their timber is that they must sell it in an unorganized market where there is no going price to guide them. But even when they know the prices being paid for other tracts, this knowledge is slight help by itself because timber prices vary widely according to the size of trees, distance to mill, and other characteristics.

Professional appraisers have found ways of overcoming these difficulties in practice. One way has been simply to gain enough experience and knowledge of the market to be able to set prices through judgment. Another, and more objective way, has been to use one of the standard appraisal procedures such as the overturn method. Unfortunately, the small landowner can use neither. He sells too infrequently to develop the sense of value that comes from comparing the price paid for one tract with that paid for another. And he finds the standard procedures are complicated and require data unavailable to him. What the occasional seller of small lots of timber needs is a simple appraisal method. This paper describes such a method which is applicable to marked pine sawtimber in South Carolina.

HOW TO ESTIMATE THE MARKET VALUE OF AN INDIVIDUAL TRACT

Using the State Average Price

In South Carolina, the price paid for a stand of marked pine sawtimber depends upon: (1) The average price being paid for pine sawtimber throughout the State, (2) the average volume per marked tree, (3) the road distance to the nearest stationary sawmill or planing mill, and (4) the geographic location of the woodland within the State. With this information, an owner can work out the market value of his tract if he will sell it as foresters advise, i.e., has his stand marked and cruised and endeavors to obtain at least three bids. Using tables 1 and 2, the only figuring necessary is one addition or subtraction. All volumes and values are in terms of Scribner scale.

Table 1. --Basic price per thousand board feet, Scribner, by State average price and average volume per tree

(In dollars)

State average price (Dollars per M bd. ft.)	Average volume per tree (board feet)													
	40	60	80	100	120	140	160	180	200	220	240	260	280	300
20	15.60	16.00	16.50	16.90	17.30	17.80	18.20	18.70	19.10	19.60	20.00	20.40	20.90	21.30
21	16.60	17.10	17.60	18.00	18.50	18.90	19.40	19.90	20.30	20.80	21.30	21.70	22.20	22.60
22	17.70	18.20	18.70	19.10	19.60	20.10	20.60	21.10	21.60	22.00	22.50	23.00	23.50	24.00
23	18.70	19.20	19.70	20.20	20.80	21.30	21.80	22.30	22.80	23.30	23.80	24.30	24.80	25.30
24	19.80	20.30	20.80	21.40	21.90	22.40	22.90	23.50	24.00	24.50	25.00	25.60	26.10	26.60
25	20.80	21.40	21.90	22.50	23.00	23.60	24.10	24.70	25.20	25.80	26.30	26.80	27.40	27.90
26	21.90	22.40	23.00	23.60	24.10	24.70	25.30	25.90	26.40	27.00	27.60	28.10	28.70	29.30
27	22.90	23.50	24.10	24.70	25.30	25.90	26.50	27.00	27.60	28.20	28.80	29.40	30.00	30.60
28	24.00	24.60	25.20	25.80	26.40	27.00	27.60	28.30	28.90	29.50	30.10	30.70	31.30	31.90
29	25.00	25.60	26.30	26.90	27.50	28.20	28.80	29.40	30.10	30.70	31.30	32.00	32.60	33.30
30	26.00	26.70	27.30	28.00	28.70	29.30	30.00	30.60	31.30	32.00	32.60	33.30	33.90	34.60
31	27.10	27.80	28.40	29.10	29.80	30.50	31.20	31.80	32.50	33.20	33.90	34.60	35.20	35.90
32	28.10	28.80	29.50	30.20	30.90	31.60	32.30	33.00	33.70	34.40	35.10	35.80	36.50	37.30
33	29.20	29.90	30.60	31.30	32.10	32.80	33.50	34.20	35.00	35.70	36.40	37.10	37.90	38.60
34	30.20	31.00	31.70	32.40	33.20	33.90	34.70	35.40	36.20	36.90	37.70	38.40	39.20	39.90
35	31.30	32.00	32.80	33.60	34.30	35.10	35.90	36.60	37.40	38.20	38.90	39.70	40.50	41.20
36	32.30	33.10	33.90	34.70	35.50	36.20	37.00	37.80	38.60	39.40	40.20	41.00	41.80	42.60
37	33.30	34.20	35.00	35.80	36.60	37.40	38.20	39.00	39.80	40.70	41.50	42.30	43.10	43.90
38	34.40	35.20	36.10	36.90	37.70	38.60	39.40	40.20	41.10	41.90	42.70	43.60	44.40	45.20
39	35.40	36.30	37.10	38.00	38.80	39.70	40.60	41.40	42.30	43.10	44.00	44.80	45.70	46.50
40	36.50	37.40	38.20	39.10	40.00	40.90	41.70	42.60	43.50	44.40	45.30	46.10	47.00	47.90
41	37.50	38.40	39.30	40.20	41.10	42.00	42.90	43.80	44.70	45.60	46.50	47.40	48.30	49.20
42	38.60	39.50	40.40	41.30	42.30	43.20	44.10	45.00	45.90	46.80	47.80	48.70	49.60	50.50
43	39.60	40.50	41.50	42.40	43.40	44.30	45.30	46.20	47.10	48.10	49.00	50.00	50.90	51.90
44	40.60	41.60	42.60	43.60	44.50	45.50	46.40	47.40	48.40	49.30	50.30	51.30	52.20	53.20
45	41.70	42.70	43.70	44.70	45.60	46.60	47.60	48.60	49.60	50.60	51.60	52.60	53.50	54.50

Table 2. --Price adjustment factors per thousand board feet, Scribner, by county and road distance from tract to nearest sawmill or planing mill

(In dollars)

County	Road distance to nearest sawmill or planing mill (miles)												
	1	2	3	4	5	6	7	8	9	10	15	20	25
Abbeville	2.90	3.00	3.10	3.20	3.40	3.50	3.60	3.80	3.90	4.00	4.60	5.30	5.90
Aiken	0.70	0.80	0.90	1.00	1.20	1.30	1.40	1.60	1.70	1.80	2.40	3.10	3.70
Allendale	1.80	2.00	2.10	2.20	2.40	2.50	2.60	2.70	2.90	3.00	3.60	4.20	4.90
Anderson	3.90	4.00	4.10	4.30	4.40	4.50	4.60	4.80	4.90	5.00	5.60	6.30	6.90
Bamberg	1.40	1.20	1.10	1.00	0.90	0.70	0.60	0.50	0.40	0.20	0.40	1.00	1.70
Barnwell	1.20	1.30	1.40	1.60	1.70	1.80	1.90	2.10	2.20	2.30	3.00	3.60	4.20
Beaufort	3.70	3.80	4.00	4.10	4.20	4.30	4.50	4.60	4.70	4.90	5.50	6.10	6.80
Berkeley	2.90	2.80	2.60	2.50	2.40	2.20	2.10	2.00	1.90	1.70	1.10	0.50	0.20
Calhoun	2.70	2.60	2.50	2.30	2.20	2.10	2.00	1.80	1.70	1.60	0.90	0.30	0.30
Charleston	1.00	1.10	1.30	1.40	1.50	1.60	1.80	1.90	2.00	2.20	2.80	3.40	4.00
Cherokee	4.70	4.80	5.00	5.10	5.20	5.40	5.50	5.60	5.70	5.90	6.50	7.10	7.80
Chester	3.50	3.70	3.80	3.90	4.00	4.20	4.30	4.40	4.60	4.70	5.30	5.90	6.60
Chesterfield	2.40	2.50	2.60	2.70	2.90	3.00	3.10	3.20	3.40	3.50	4.10	4.80	5.40
Clarendon	0.90	0.70	0.60	0.50	0.40	0.20	0.10	0.00	0.20	0.30	0.90	1.60	2.20
Colleton	0.20	0.30	0.40	0.50	0.70	0.80	0.90	1.00	1.20	1.30	1.90	2.60	3.20
Darlington	1.70	1.60	1.40	1.30	1.20	1.10	1.00	0.80	0.70	0.60	0.10	0.70	1.30
Dillon	1.20	1.10	0.90	0.80	0.70	0.60	0.40	0.30	0.20	0.00	0.60	1.20	1.80
Dorchester	2.60	2.40	2.30	2.20	2.00	1.90	1.80	1.70	1.50	1.40	0.80	0.10	0.50
Edgefield	0.00	0.10	0.20	0.40	0.50	0.60	0.70	0.90	1.00	1.10	1.80	2.40	3.00
Fairfield	3.20	3.30	3.50	3.60	3.70	3.80	4.00	4.10	4.20	4.40	5.00	5.60	6.20
Florence	1.90	1.70	1.60	1.50	1.40	1.20	1.10	1.00	0.80	0.70	0.10	0.50	1.20
Georgetown	1.00	0.90	0.80	0.70	0.50	0.40	0.30	0.10	0.00	0.10	0.80	1.40	2.00
Greenville	4.20	4.30	4.50	4.60	4.70	4.90	5.00	5.10	5.20	5.40	6.00	6.60	7.30
Greenwood	1.30	1.50	1.60	1.70	1.80	2.00	2.10	2.20	2.40	2.50	3.10	3.80	4.40
Hampton	1.50	1.60	1.80	1.90	2.00	2.20	2.30	2.40	2.50	2.70	3.30	3.90	4.60
Horry	2.00	2.10	2.30	2.40	2.50	2.60	2.80	2.90	3.00	3.20	3.80	4.40	5.10
Jasper	0.50	0.60	0.80	0.90	1.00	1.10	1.20	1.40	1.50	1.60	2.30	2.90	3.50
Kershaw	0.40	0.20	0.10	0.00	0.20	0.30	0.40	0.50	0.70	0.80	1.40	2.10	2.70
Lancaster	2.70	2.80	3.00	3.10	3.20	3.30	3.40	3.60	3.70	3.80	4.50	5.10	5.70
Laurens	4.00	4.20	4.30	4.40	4.60	4.70	4.80	4.90	5.10	5.20	5.80	6.40	7.10
Lee	2.50	2.60	2.80	2.90	3.00	3.20	3.30	3.40	3.50	3.70	4.30	4.90	5.60
Lexington	0.70	0.60	0.40	0.30	0.20	0.00	0.10	0.20	0.30	0.50	1.10	1.70	2.40
McCormick	0.20	0.00	0.10	0.20	0.30	0.50	0.60	0.70	0.80	1.00	1.60	2.20	2.90
Marion	3.00	3.20	3.30	3.40	3.50	3.70	3.80	3.90	4.00	4.20	4.80	5.40	6.10
Marlboro	2.40	2.20	2.10	2.00	1.90	1.70	1.60	1.50	1.40	1.20	0.60	0.00	0.70
Newberry	0.80	1.00	1.10	1.20	1.30	1.50	1.60	1.70	1.80	2.00	2.60	3.20	3.90
Oconee	0.50	0.40	0.30	0.10	0.00	0.10	0.20	0.40	0.50	0.60	1.30	1.90	2.50
Orangeburg	2.00	1.90	1.80	1.70	1.50	1.40	1.30	1.20	1.00	0.90	0.30	0.40	1.00
Pickens	2.20	2.30	2.40	2.60	2.70	2.80	2.90	3.10	3.20	3.30	4.00	4.60	5.20
Richland	1.70	1.80	1.90	2.00	2.20	2.30	2.40	2.60	2.70	2.80	3.40	4.10	4.70
Saluda	0.30	0.40	0.60	0.70	0.80	1.00	1.10	1.20	1.30	1.50	2.10	2.70	3.40
Spartanburg	4.60	4.70	4.80	4.90	5.10	5.20	5.30	5.40	5.60	5.70	6.30	7.00	7.60
Sumter	1.50	1.40	1.30	1.20	1.00	0.90	0.80	0.60	0.50	0.40	0.20	0.90	1.50
Union	3.40	3.50	3.60	3.70	3.90	4.00	4.10	4.20	4.40	4.50	5.10	5.80	6.40
Williamsburg	2.20	2.10	2.00	1.80	1.70	1.60	1.40	1.30	1.20	1.10	0.40	0.20	0.80
York	4.40	4.50	4.60	4.80	4.90	5.00	5.10	5.30	5.40	5.50	6.20	6.80	7.40

Note: Add shaded values; subtract unshaded.

Here, illustrated with an example, is how to appraise timber by this method. The cruise of the tract to be appraised shows an average volume per tree of 120 board feet. The tract is located in Newberry County, 3 miles from the nearest sawmill. How much is the timber worth when the current State average price for marked pine is $35.00 per thousand board feet?

To find out, look first in table 1, and where the 120-board-foot column intersects the $35.00 row, the basic price is $34.30. Next, look in table 2, and where the 3-mile column intersects the Newberry County row, the price adjustment factor is minus $1.10. Then, to get the value of this tract, subtract $1.10 from $34.30. Its appraised worth is $33.20 per thousand board feet.

This figure is only an estimate, of course, so the seller would not expect to receive exactly this amount. Nevertheless, he should be hesitant about accepting an offer more than five dollars below this value.

Using the Local Average Price

One item of information necessary to the above method may be difficult for an owner to obtain. This is the State average price. It is not published regularly, and the State Forester may be unable to supply the current average.

Even under these circumstances, stands can still be appraised by using an approximation method which substitutes the local price for the State average. To use it, the owner must again know the average volume per tree and the distance to the nearest mill. He must, in addition, have the same information for the tract (or group of tracts) he uses for comparison. Of course, by using local prices, he can ignore the county in which the tracts are located. Most of the arithmetic for this method has been worked out in table 3.

Table 3. --Price indicators per thousand board feet, Scribner, by road distance from tract to nearest sawmill or planing mill and average volume per tree

(In dollars)

Road distance to nearest sawmill or planing mill (Miles)	Average volume per tree (board feet)													
	40	60	80	100	120	140	160	180	200	220	240	260	280	300
1	5.10	5.80	6.50	7.20	7.80	8.50	9.20	9.90	10.60	11.30	12.00	12.70	13.40	14.10
2	4.90	5.60	6.20	6.90	7.60	8.30	9.00	9.70	10.40	11.10	11.80	12.50	13.20	13.90
3	4.70	5.30	6.00	6.70	7.40	8.10	8.80	9.50	10.20	10.90	11.60	12.30	13.00	13.70
4	4.40	5.10	5.80	6.50	7.20	7.90	8.60	9.30	10.00	10.70	11.40	12.10	12.80	13.50
5	4.20	4.90	5.60	6.30	7.00	7.70	8.40	9.10	9.80	10.50	11.20	11.90	12.60	13.20
6	4.00	4.70	5.40	6.10	6.80	7.50	8.20	8.90	9.60	10.30	11.00	11.60	12.30	13.00
7	3.80	4.50	5.20	5.90	6.60	7.30	8.00	8.70	9.40	10.10	10.70	11.40	12.10	12.80
8	3.60	4.30	5.00	5.70	6.40	7.10	7.80	8.50	9.10	9.80	10.50	11.20	11.90	12.60
9	3.40	4.10	4.80	5.50	6.20	6.90	7.50	8.20	8.90	9.60	10.30	11.00	11.70	12.40
10	3.20	3.90	4.60	5.30	5.90	6.60	7.30	8.00	8.70	9.40	10.10	10.80	11.50	12.20
15	2.10	2.80	3.50	4.20	4.90	5.60	6.30	7.00	7.70	8.40	9.10	9.70	10.40	11.10
20	1.10	1.80	2.40	3.10	3.80	4.50	5.20	5.90	6.60	7.30	8.00	8.70	9.40	10.10
25	0.00	0.70	1.40	2.10	2.80	3.50	4.20	4.90	5.60	6.20	6.90	7.60	8.30	9.00

Now let us see how a seller would use this approximation method when his stand has an average volume per marked tree of 200 board feet and is 4 miles from the nearest mill. Through inquiry, he finds that the current

average price being paid locally for marked pine sawtimber is $30.00 per thousand board feet. He finds further, that on the average these local stands have a mean volume per tree of 120 board feet, and are 5 miles from the nearest mill.

To appraise his timber, the seller first looks up in table 3 the price indicators for both his tract and the average tract. He finds that the price indicator for his is $10.00 and for the average is $7.00. Next, he takes the difference between the two price indicators, which is $3.00. Finally, he adds this difference to the local price because the indicator for his tract is greater than the one for the average. If the indicator for his tract had been smaller than that for the average, then he would have subtracted the difference between the two indicators from the local price. In the example given, the timber is worth 30 + 3, or $33.00 per thousand board feet.

COMPARING PRICES QUOTED IN VARIOUS LOG RULES

All of the above values have been based on Scribner volumes. Not all bids, of course, will necessarily be in terms of this rule. Some may be in Doyle; others in International or lumber tally, which is approximately the same. To compare offers, all must be put on the same basis. This can be done easily by using table 4 or 5, whichever is appropriate.

Table 4. --Multiplying factors for converting prices in terms of Doyle rule to a Scribner-rule basis

Average volume per tree (Board feet)	D. b. h. class with greatest volume (inches)								
	10	12	14	16	18	20	22	24	26
50	0.575	0.591	0.607	0.622	0.638	0.654	0.669	0.685	0.701
55	.583	.599	.614	.630	.646	.662	.677	.693	.709
60	.591	.607	.623	.639	.654	.670	.686	.701	.717
65	.600	.616	.631	.647	.663	.678	.694	.710	.725
70	.608	.624	.640	.655	.671	.687	.702	.718	.734
75	.616	.631	.647	.663	.679	.694	.710	.726	.741
80	.623	.639	.655	.670	.686	.702	.717	.733	.749
85	.630	.646	.662	.677	.693	.709	.724	.740	.756
90	.637	.652	.668	.684	.699	.715	.731	.746	.762
95	.642	.658	.674	.690	.705	.721	.737	.752	.768
100	.648	.664	.680	.695	.711	.727	.742	.758	.774
110	.658	.674	.690	.705	.721	.737	.752	.768	.784
120	.667	.683	.699	.714	.730	.746	.761	.777	.793
130	.675	.691	.707	.722	.738	.754	.769	.785	.801
140	.682	.698	.714	.729	.745	.761	.776	.792	.808
150	.688	.704	.720	.735	.751	.767	.783	.798	.814
160	.694	.710	.725	.741	.757	.773	.788	.804	.820
170	.699	.715	.730	.746	.762	.777	.793	.809	.824
180	.703	.719	.735	.750	.766	.782	.798	.813	.829
190	.708	.723	.739	.755	.770	.786	.802	.817	.833
200	.712	.727	.743	.759	.774	.790	.806	.821	.837
220	.718	.734	.749	.765	.781	.796	.812	.828	.844
240	.724	.739	.755	.771	.787	.802	.818	.834	.849
260	.728	.744	.760	.776	.791	.807	.823	.838	.854
280	.733	.748	.764	.780	.795	.811	.827	.843	.858
300	.737	.752	.768	.784	.799	.815	.831	.846	.862
350	.744	.760	.776	.791	.807	.823	.838	.854	.870
400	.750	.766	.781	.797	.813	.828	.844	.860	.875
450	.754	.770	.786	.801	.817	.833	.848	.864	.880
500	.758	.774	.790	.805	.821	.837	.852	.868	.884

Table 5. --Multiplying factors for converting prices in terms of International $\frac{1}{4}$-inch rule (or lumber tally) to a Scribner-rule basis

Average volume per tree (Board feet)	D. b. h. class with greatest volume (inches)								
	10	12	14	16	18	20	22	24	26
50	1.224	1.218	1.212	1.207	1.201	1.195	1.190	1.184	1.179
55	1.216	1.210	1.205	1.199	1.193	1.188	1.182	1.176	1.171
60	1.209	1.203	1.198	1.192	1.186	1.181	1.175	1.169	1.164
65	1.203	1.197	1.191	1.186	1.180	1.174	1.169	1.163	1.157
70	1.197	1.191	1.186	1.180	1.174	1.169	1.163	1.157	1.152
75	1.192	1.186	1.181	1.175	1.169	1.164	1.158	1.152	1.147
80	1.187	1.181	1.176	1.170	1.165	1.159	1.153	1.148	1.142
85	1.183	1.177	1.172	1.166	1.160	1.155	1.149	1.143	1.138
90	1.179	1.173	1.168	1.162	1.157	1.151	1.145	1.140	1.134
95	1.176	1.170	1.164	1.159	1.153	1.147	1.142	1.136	1.130
100	1.172	1.167	1.161	1.155	1.150	1.144	1.138	1.133	1.127
110	1.167	1.161	1.155	1.150	1.144	1.138	1.133	1.127	1.122
120	1.162	1.156	1.150	1.145	1.139	1.134	1.128	1.122	1.117
130	1.158	1.152	1.146	1.141	1.135	1.129	1.124	1.118	1.112
140	1.154	1.148	1.143	1.137	1.131	1.126	1.120	1.114	1.109
150	1.151	1.145	1.139	1.134	1.128	1.122	1.117	1.111	1.105
160	1.148	1.142	1.136	1.131	1.125	1.120	1.114	1.108	1.103
170	1.145	1.140	1.134	1.128	1.123	1.117	1.111	1.106	1.100
180	1.143	1.137	1.132	1.126	1.120	1.115	1.109	1.103	1.098
190	1.141	1.135	1.130	1.124	1.118	1.113	1.107	1.101	1.096
200	1.139	1.133	1.128	1.122	1.116	1.111	1.105	1.099	1.094
220	1.136	1.130	1.124	1.119	1.113	1.107	1.102	1.096	1.090
240	1.133	1.127	1.122	1.116	1.110	1.105	1.099	1.093	1.088
260	1.130	1.125	1.119	1.114	1.108	1.102	1.097	1.091	1.085
280	1.128	1.123	1.117	1.111	1.106	1.100	1.095	1.089	1.083
300	1.127	1.121	1.115	1.110	1.104	1.098	1.093	1.087	1.081
350	1.123	1.117	1.112	1.106	1.100	1.095	1.089	1.083	1.078
400	1.120	1.115	1.109	1.103	1.098	1.092	1.086	1.081	1.075
450	1.118	1.112	1.107	1.101	1.096	1.090	1.084	1.079	1.073
500	1.116	1.111	1.105	1.099	1.094	1.088	1.082	1.077	1.071

Prices quoted in Doyle rule can be converted to Scribner by using table 4. The same thing can be done with prices given in terms of International $\frac{1}{4}$-inch rule or lumber tally by using table 5. All the seller needs to know is the average volume per tree and the d. b. h. class which contains the greatest volume, for his marked trees. For example, if the average volume per tree is 110 board feet and the d. b. h. class with the greatest volume is 14 inches, the Doyle-to-Scribner converting factor is 0.690 and the International- or lumber tally-to-Scribner converting factor is 1.155. For this stand, then, an offer of $43.50 per thousand board feet, in Doyle, would be equivalent to $30.00 per thousand board feet, Scribner ($43.50 x 0.690 = $30.00); and a quotation of $26.00 per thousand board feet, in International (or lumber tally), would also be equal to $30.00 per thousand board feet, Scribner ($26.00 x 1.155 = $30.00).

DETERMINATION OF THE PRICE ESTIMATING EQUATION

The appraisal method just described is a practical way of applying the results of a study which was designed to explain tract-to-tract variations in timber prices. This is the third in a series of studies conducted by this Station with the objective of explaining stumpage price variation among pine stands. The first of these investigations, conducted in Georgia by Todd and Zirkle,[1/] attempted to identify both quantitative and qualitative factors affecting price. The second, an exploratory study by Cruikshank and Anderson,[2/] endeavored to explain price differences among sales of pine sawtimber in South Carolina in terms of measurable stand characteristics. The present study is similar to the second, but many more variables have been tested.

The Sample of Sales

The data used in this investigation were taken from service foresters' reports to the South Carolina State Commission of Forestry. Service foresters, operating under the Cooperative Forest Management Act of 1950, mark privately owned stands for cutting, among the other functions they perform. For a portion of the marked tracts, they reported the price paid, the date of sale, the number of bids received, the location of the tract, and the tally of the trees marked. From these records, reports for 93 sales were selected for analysis.

Although originally made for administrative rather than research purposes, these reports were particularly well suited to this study. First, they included sales made throughout the State. Second, the prices paid were for tracts that had been marked and cruised by a qualified timber marker, so each seller knew the volume he was offering for sale. And in 85 percent of the cases the seller received more than one bid. Finally, the prices could be readily analyzed because stand characteristics and other factors that might influence price were known for each sale.

To relate stumpage price to each of its determinants, it is desirable to have all other factors held constant. For this reason, the ideal sales to analyze would appear to be those that had all taken place at the same time, i.e., cross-section data. But, unfortunately, results could not explain price differences among tracts at any other point in time when the price level might be either lower or higher. More suitable data for a price study intended as the basis for a timber appraisal method should be those from sales made during an interval of several years. Differences in price levels at the time each sale took place can be eliminated by expressing each individual price as a deviation from the current average price at the time the

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1/ Todd, A. S., Jr., and Zirkle, J. J., Jr. Marketing farm timber in Monroe County, Georgia. U. S. Forest Serv. Southeast. Forest Expt. Sta. Paper 3, 33 pp. 1949.

2/ Cruikshank, J. W., and Anderson, W. C. Pine sawtimber stumpage prices in South Carolina, 1948-1954. U. S. Forest Serv. Southeast. Forest Expt. Sta. Paper 57, 14 pp. 1955.

sale was made. When this is done, differences in the prices paid for various tracts can be explained in the same manner as with cross-section data. Furthermore, in instances where the relationship of stumpage price to any of its determinants is influenced by the price level, the current average price can be included as an independent variable in the estimating equation. Therefore, for this study, sales were selected that had occurred between 1946 and 1956.

During this 10-year period, the general level of pine sawtimber prices tended upward, but also fluctuated widely around this trend (fig. 1). Before attempting to remove the influence of both the long-term and short-term movements, tests were made to detect differences in the general price pattern among the seven forest districts of the State. There were none, so it was reasonable to adjust all individual prices to one base price level. To do this, first, 354 prices were plotted by year and month of sale, and then a line was drawn which passed through the annual average prices and followed the ups and downs of the monthly averages. This line represented the general price level in the State throughout this interval. Next, each of the prices paid in the 93 sales used in the analysis was measured as a difference between the price actually paid and the current average price for the State in the month the sale was made. Finally, these differences were added algebraically to the grand average price for the entire period, thereby getting rid of negative numbers. Because none of the stand variables or other factors likely to be related to price showed any trend over the period, these prices appeared to satisfactorily simulate those collected at one point in time and were the ones used in the analysis.

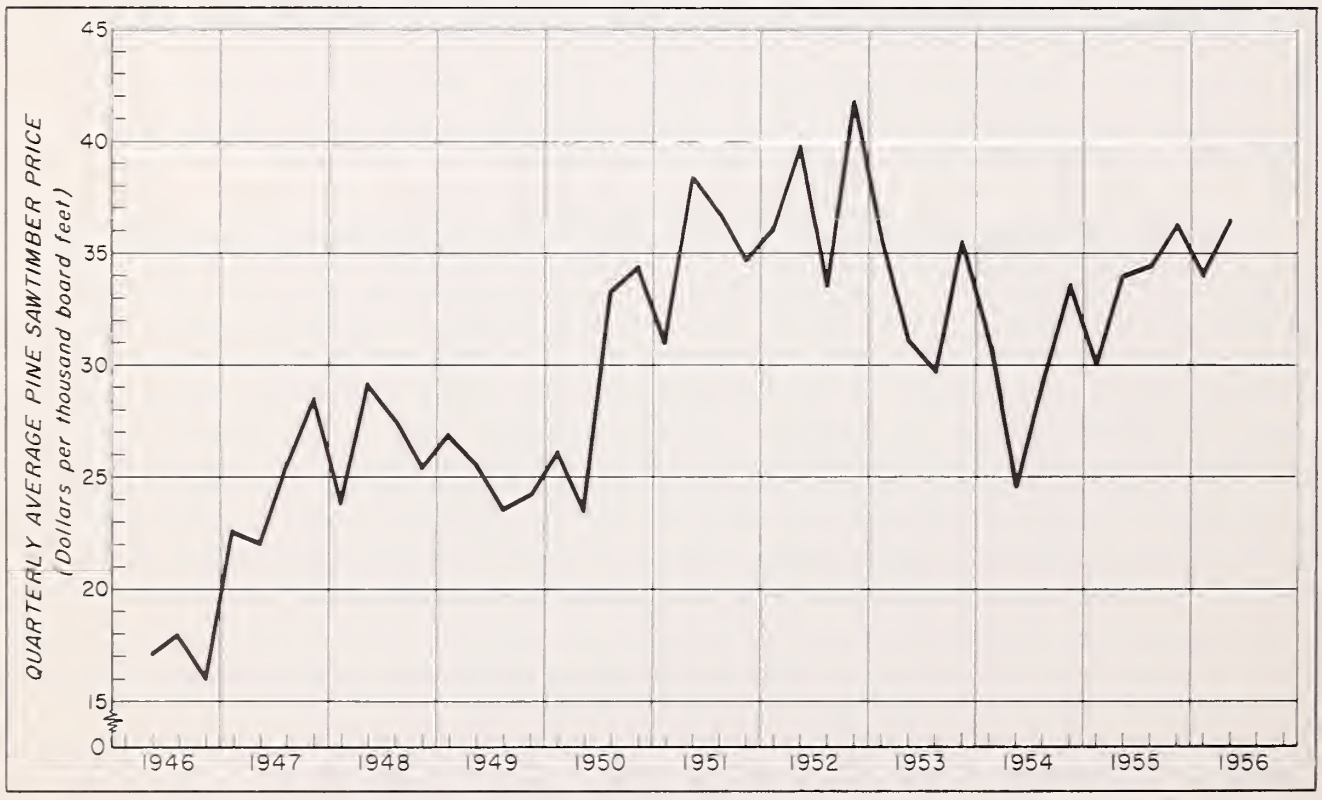

Figure 1. --Stumpage prices moved upward but fluctuated widely about the trend. Within years, prices tended to be highest in the fall.

The Potential Price Determinants

In appraisals made according to standard procedures, stumpage price is treated as a residual value. It is computed by deducting production costs and allowances for profit and risk from the selling price for lumber. If this approach is rational, then the factors that influence the price paid for a particular lot of standing trees must operate indirectly through their effect on the value of lumber that can be produced, the cost of producing and delivering it to market, and the amount allowed for the operator's profit and risk.

Although the price received for any delivery of lumber is determined almost entirely by the level of average lumber prices, more or less may be paid for the lumber from a particular tract depending upon the size and quality of the boards that are sawed. Logging and milling costs are affected by the size of trees, their spacing, and the character of the area they occupy. Lumber and log transportation costs vary with distance from the tract to the mill and the type of roads over which the loads are hauled. The degree of competition among bidders limits the allowance for profit and risk the buyer can claim. The effects of these general factors are reflected in the stumpage price.

Of the numerous measures of possible price determinants, 23 could be tested for their relationship to price with the data available. Specifically, these were:

Number of acres in sale area
Total volume marked and sold
Average volume marked per acre
Proportion of volume in trees over 19 inches d. b. h.
Proportion of volume in trees over 15 inches d. b. h.
Average volume per marked tree
Average number of trees marked per acre
Average d. b. h. of marked trees
Average merchantable height of marked trees
Ratio of d. b. h. to merchantable height
Stand quality (a qualitative estimate)
Average form class of marked trees
Distance from tract to nearest all-weather road
Distance by road from tract to nearest stationary sawmill or planing mill
Number of bids received
Total area of forest on timber seller's land
Proportion of seller's land in forest
Number of sawmills in county
Annual lumber production in county
Annual softwood lumber production in county
Annual softwood lumber production per million board feet of softwood sawtimber inventory in county
Average annual income per farm in county
Geographic location

The Factors Related to Price

Regression analysis showed that of the variables considered, only four were significant. These were: (1) Volume per tree, (2) distance to mill, (3) number of bids, and (4) geographic location. Together, these four variables explained 58 percent of the price variance.

The relationship between price and average size of marked trees was positive. The average volume per tree for all tracts used in computing this equation was 154 board feet. The tract containing the smallest trees had an average of only 52 board feet; the one with the largest trees had an average of 476 board feet. Buyers were willing to pay a higher price per thousand board feet for stands of large trees because (1) they could harvest and convert them to lumber more cheaply, and (2) large trees yield a higher proportion of No. 1 common and better lumber.

The relationship of price to tree size depended on the level of average timber prices. At high price levels, buyers paid a greater premium for large trees than they did at low price levels (fig. 2). For example, when the average price was down to $20.00, only $2.20 more per thousand was paid for a stand with an average volume of 300 board feet per tree than for one with 200 board feet per tree. But when the price level went up to $35.00, the price difference between stands of these sizes was $3.80 per thousand board feet.

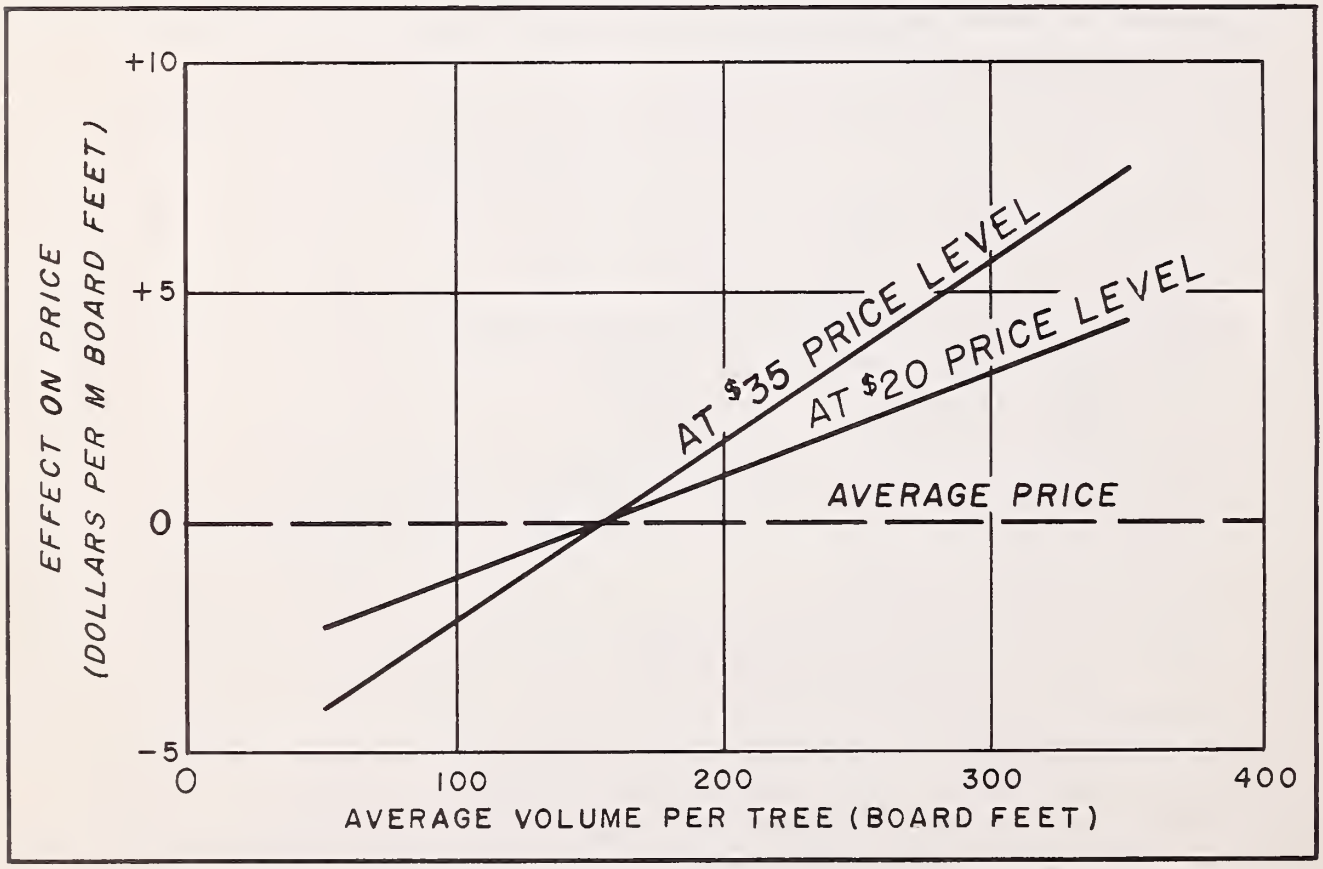

Figure 2. --Higher prices were paid for sawtimber stands with large trees, especially when the State average price was high.

Either the logs or the rough, green lumber cut at the tract had to be hauled at least as far as the nearest stationary sawmill or planing mill. The shortest distance for any sale was 1 mile, the longest was 25 miles, and the average was 6 miles. In all sales, of course, the mill nearest the tract had a competitive advantage. Nearness to mill may also be a rough indicator of the number of mills in the area, which would affect the competition for stumpage. There was a negative relationship between price and the distance to this mill (fig. 3). Each additional mile from the nearest mill reduced stumpage price by an average of 13 cents per thousand board feet.

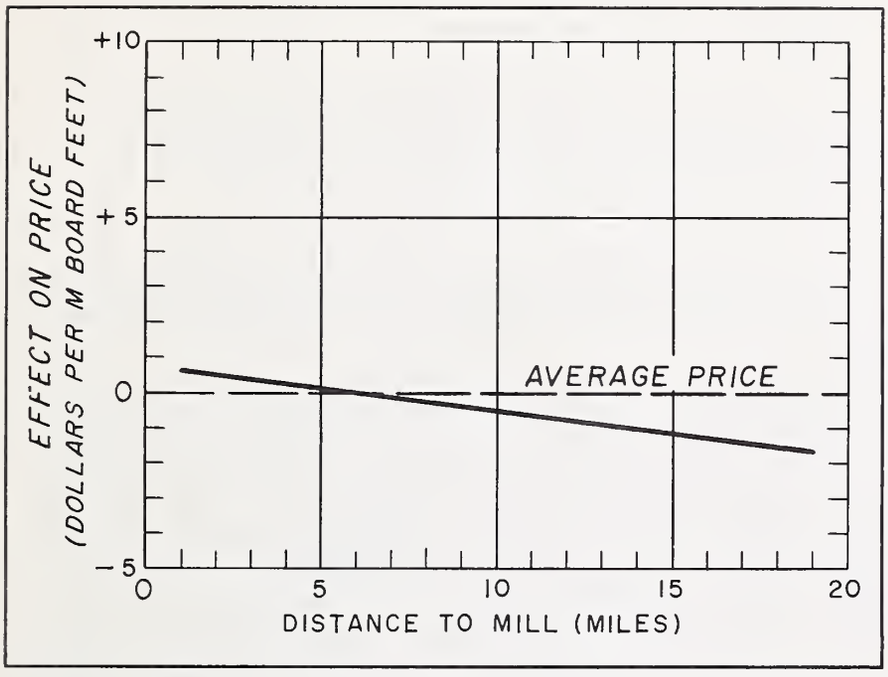

Figure 3. --Sawtimber prices declined with increases in the hauling distance to the nearest stationary sawmill or planing mill.

The number of bids an owner received indicated the amount of competition among interested buyers. Of course, the more intensive this competition, the higher the price the seller was likely to get. The number of bids received in individual sales ranged from 1 to 11, and the average was 3. Up to three bids, each additional bid increased the sawtimber price by $1.25 per thousand board feet (fig. 4). But beyond this number, additional bids apparently had a negligible effect on the price.

After both the effect of average volume per tree and distance to mill had been removed, there still remained a residual variability of price associated with geographic location. Prices tended to increase from the northwest corner of the State toward the coast (fig. 5). However, tidewater counties had lower average prices than those only a short distance inland. To measure the effect of geographic location, counties were arrayed on the basis of average prices calculated from 354 sales, and assigned ranks from lowest to highest. There was an average difference of 17 cents between counties with adjacent ranks, or $7.60 between the counties with the highest and lowest ranking. Consequently, an equation incorporating county rank is a better estimator than one without it.

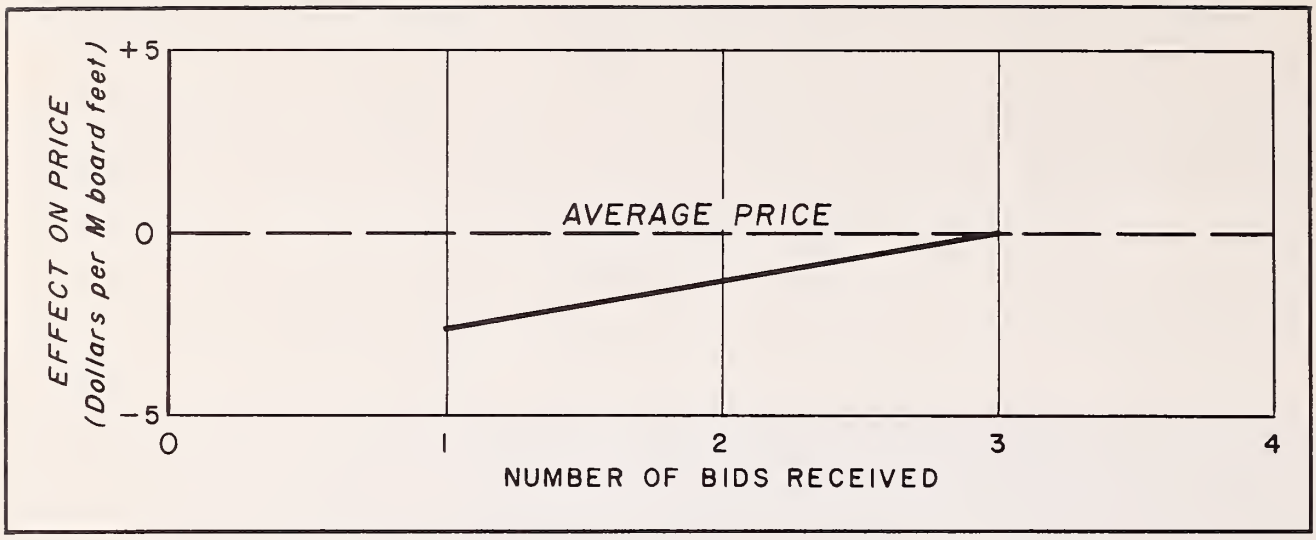

Figure 4. --Prices paid for sawtimber stands were lowest where competition for the timber, as reflected in the number of bids received, was least.

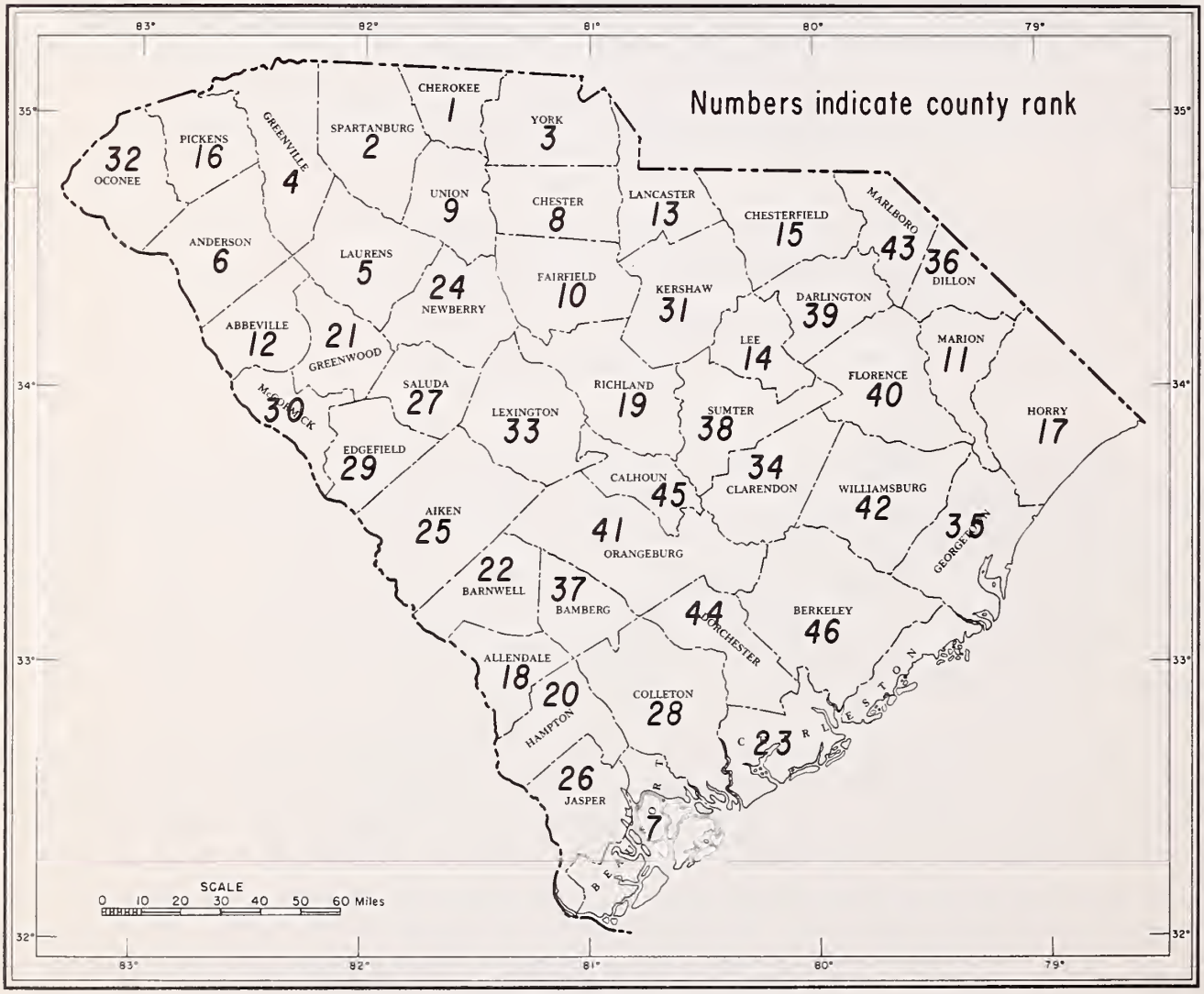

Figure 5. --When counties were ranked by average price from lowest to highest, county rank tended to increase from the northwestern part of the State toward the coast, but was lower along the coast.

The relationship of each of these four significant variables to price is shown in the following estimating equations:

$$y = 0.001096x_1 - 0.126939x_2 + 1.257878x_3 + 0.168988x_4$$

where the variables, expressed as deviations from their respective means are:

y = estimated pine sawtimber price in dollars per thousand board feet

x_1 = State average price in dollars per thousand board feet times the average volume per marked tree in board feet

x_2 = road distance to the nearest stationary sawmill or planing mill in miles

x_3 = number of bids received

x_4 = rank of county when counties were arrayed in order from those with the lowest to those with the highest average price

For this equation, the standard error for the estimated price of an individual tract was $4.60 per thousand board feet (14 percent at the mean).

To simplify application of this equation, the values in tables 1 and 2 were calculated. To illustrate how table 1 was obtained, consider a tract with an average volume per tree of 100 board feet sold at a time when the current State average price was $30.00 per thousand board feet. The first step in computing the "basic price" shown in this cell of the table was to multiply the average volume per tree by the current State average price, 100 (30) = 3000. Second, the difference was found between 3000 and the mean of the equivalent values for all tracts used in the study, 3000 - 4813 = -1813. Third, this difference was multiplied by the regression coefficient for x_1 shown in the equation, 0.001096 (-1813) = -1.99. Finally, this result was added algebraically to the current State average price, 30.00 - 1.99 = 28.01. This gave the basic price, $28.00, when rounded to the nearest ten cents.

For a tract located in Richland County 4 miles from the nearest sawmill, the factor shown in table 2 was obtained as follows: First, the distance to the mill was expressed as the difference between the actual distance of this tract from the nearest mill and the mean distance of all tracts from the mill nearest them, 4.0 - 6.1 = -2.1. When this value was multiplied by the regression coefficient for x_2, the effect of distance on price was -0.126939 (-2.1) = 0.27. Next, the effect of geographic location on price was found by taking the difference between the rank of Richland County, nineteenth, and the mean county rank of all tracts, 19.0 - 29.5 = -10.5, and multiplying this difference by the coefficient for x_4, 0.168988 (-10.5) = -1.77. Then the adjustment of the estimated price to a 3-bid basis was also included in this factor. This was done by subtracting the mean number of bids, 3.44, from 3 and multiplying the result by the coefficient for x_3, 1.257878 (-0.44) = -0.55. Lastly, these three price effects were summed algebraically, 0.27 - 1.77 - 0.55 = -2.05, and the answer was rounded to the nearest ten cents, i.e., - $2.00. This is the "price adjustment factor" shown for this cell in table 2.

The values in table 3 were worked out in a similar fashion to those in tables 1 and 2 except, of course, they were based on an estimating equation that excluded geographic location. The regression coefficients of the variables retained in this equation were:

$$y = 0.001315x_1 - 0.221477x_2 + 1.497471x_3$$

where the variables are identified by the same symbols used in the first equation.

One variable, which previous studies found to influence stumpage price, failed to show significance in this study. It was volume per acre. This different result appears to be primarily due to the number of observations involved. In the earlier study of South Carolina pine stumpage prices, 3/ based on 380 sales, volume per acre was significant at the 5-percent level. This was no longer true, however, when the number of sales was reduced to only 93. Apparently the association between this factor and price was so slight it could be detected only with a large sample.

ADDITIONAL FACTORS THAT MAY BE RELATED TO PRICE

In addition to those considered in this study, there may be other factors that significantly influence stumpage price but could not be tested because they had not been measured. Three outstanding factors left out of the analysis for this reason were: (1) Accessibility to the tract, (2) difficulty of the logging chance, and (3) quality of the stand.

Accessibility and difficulty of the logging chance are generally related. Over much of the State, most tracts are near all-weather roads and the topography does not hamper logging. But those areas in the mountains and along the coast where logging is most difficult are often the least accessible. The difficulty of reaching and working coastal stands may be one reason why stumpage prices are lower there.

Stand quality was considered in this analysis only in a rough way. It was measured in part by tree size, and in part by the ratio of average tree height to average d.b.h. A subjective estimate of stand quality was also tested. But there was no measure of knottiness or other degrading factors. Whether or not quality affects stumpage price in this State is a matter of conjecture. In an area such as this where the portable mills cut and sell rough, green lumber and many of the larger mills use gang saws to increase output, it is possible that stand quality is of minor importance.

3/ See footnote 2.

CONCLUSIONS

This study provides a method for translating the general average price into the average price a specific tract would bring. It demonstrates that in spite of the great variability in the characteristics of pine sawtimber in South Carolina, well over half of the price variation among tracts can be explained with a few measurable variables.

Of course, the analysis does not provide a complete explanation of price behavior. But in our daily lives, we accept many imprecise explanations because of their usefulness. And by reducing the number of factors represented in the complex process of setting a price on stumpage, we can express useful information about this process which otherwise would have to be accepted as random. As better ways are found for measuring potential price determinants, the explanation of stumpage prices may be further improved. In this way, we can provide better market information to timber sellers than has been available in the past.

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